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ABSTRACT

A study was conducted at Cuyahoga Community College to test the relationship between student scores on timed and untimed reading comprehension and vocabulary tests, and to investigate the relationship between those scores and intelligence. The study sample included 72 students enrolled in classes at developmental, freshman, and sophomore levels. The students were given the Nelson Denny Reading Test (NDRT) both as a timed and an untimed test, and their NDRT results were compared with their scores on the Degrees of Reading Power (DRP) test and on the Peabody Picture Vocabulary Test (PPVT). Study findings, based on the scores of the 57 students who took all three tests, included the following: (1) the DRP and NDRT measured different types of reading communication; (2) the DRP tended to overestimate students' reading abilities, and underestimate the number of high-risk students; (3) the vocabulary section of the NDRT showed potential for use to estimate students' academic potential; and (4) reading comprehension and intelligence were correlated. (AJL)

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ED301248

Vocabulary, Intelligence, and Reading Comprehension

by

Dennis Gabriel
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Cuyahoga Community College
August 1988

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Abstract

READING COMPREHENSION, INTELLIGENCE AND VOCABULARY

To test the relationship between timed and untimed (reading comprehension and vocabulary) tests and the relationship between intelligence and reading comprehension and vocabulary, 72 students on a suburban campus of a community college were given the Nelson Denny Reading Test, Form C, (ND) as a timed and an untimed test. The results were compared to the students' scores on the Degrees of Reading Power, CP1A, (DRP) and to the Peabody Picture Vocabulary Test (PPVT).

Subjects for the study were enrolled in an English 099, English 101, Principles of Management 112, Business Law 213, and Business Law 214. Subjects from three academic levels (developmental, freshman, sophomore) were selected to broaden the testing base to include representative community college students. The students were tested during the first three weeks of the summer 1988 quarter. Out of the 72 students who took at least one of the tests, only 57 took the ND (as both a timed and untimed test), DRP and PPVT.

For the 57 students who took all of the tests, the study found that on the ND there is a .70 correlation between timed and untimed reading comprehension, .78 between timed and untimed vocabulary. The ND timed comprehension correlated .60 with the DRP and .62 with the PPVT. The ND timed vocabulary correlated .64 with the ND timed comprehension, .73 with the DRP, and .84 with the PPVT.

Several conclusions followed from the study. First, the DRP and the ND measure different types of comprehension, and instructors must take this difference into account when they interpret results of the tests and make textbook selections based upon the DRP's results. Second, the DRP tends to overestimate students' reading abilities. Third, the vocabulary section of the ND may be used to estimate students' ability. Four, reading comprehension and intelligence were correlated.

Several recommendations followed from the study. First, the College should use an untimed reading test, not a timed reading test. Second, if the DRP is used, instructors should note that it does not test comprehension in the same sense that the ND tests comprehension and that the DRP may underestimate the number of high risk students. Third, the study should be replicated with entry level students in the fall quarter. Also, the use of the ND (untimed) vocabulary test as a measure of student potential should be studied.

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The Problem

Background of the Problem

The Nelson Denny Reading Test (ND) has been used by members of the English Department at the Western Campus of Cuyahoga Community College over the past ten years to measure students' comprehension skills. However, research offered by Clary (1973) and Kerstiens (1986) indicates that timed reading tests have serious drawbacks. Research at the campus level has shown that the comprehension levels for new students have significantly dropped since 1979; however, little campus research has been collected to indicate how well the typical student--not a student entering college--comprehends reading material.

Students have complained that in high school they have been taught to read for comprehension--not for rate--and that the use of a timed test (such as the ND) does not measure their performance. Thus, some members of the English Department have begun using the Degrees of Reading Power (DRP) to estimate students' reading comprehension. The use of the two reading comprehension tests raises questions about the merits of each test.

In reading classes, instructors pay attention to reading comprehension, but how much attention should be given to vocabulary development appears to be a moot point. The English Department has not used individualized tests such as the Peabody Picture Vocabulary Test (PPVT) to measure vocabulary.

Purposes of the Study

The primary objective of this study was to determine the correlation between a timed and untimed (comprehension and vocabulary) reading test, the ND. If the correlation between timed and untimed tests is low, students may be better served by untimed tests. Second, the study focused upon the relation between intelligence and reading tests. If the correlation between vocabulary test scores and intelligence is high, it may be that intelligence and the ability to comprehend can be raised through intensive work in vocabulary development.

Statement of Null Hypotheses

The following null hypotheses were tested by means of a Pearson correlation coefficient.

1Ho: There is no marked correlation between the timed comprehension scores on the ND and the untimed comprehension scores on the ND.

2Ho: There is no marked correlation between the timed comprehension scores on the ND and timed vocabulary scores on the ND.

3Ho: There is no marked correlation between the timed comprehension scores on the ND and untimed vocabulary scores on the ND.

4Ho: There is no marked correlation between timed reading comprehension scores on the ND and the comprehension scores on the DRP.

5Ho: There is no marked correlation between timed reading comprehension scores on the ND and the scores on the PPVT.

6Ho: There is no marked correlation between the

untimed reading comprehension scores on the ND and timed vocabulary scores on the ND.

7Ho: There is no marked correlation between the untimed comprehension scores on the ND and untimed vocabulary scores on the ND.

8Ho: There is no marked correlation between untimed reading comprehension scores on the ND and the comprehension scores on the DRP.

9Ho: There is no marked correlation between untimed reading comprehension scores on the ND and the scores on the PPVT.

10Ho: There is no marked correlation between timed vocabulary scores on the ND and untimed vocabulary scores on the ND.

11Ho: There is no marked correlation between timed vocabulary scores on the ND and scores on the DRP.

12Ho: There is no marked correlation between timed vocabulary scores on the ND and scores on the PPVT.

13Ho: There is no marked correlation between untimed vocabulary scores on the ND and scores on the DRP.

14Ho: There is no marked correlation between untimed vocabulary scores on the ND and scores on the PPVT.

15Ho: There is no marked correlation between scores on the DRP and scores on the PPVT.

Importance of the Study

The study's importance centers around several questions. First, should we continue to use timed reading tests? Second, can a timed or untimed vocabulary test provide an indication of a student's ability? Third, do the ND and the DRP both have the same construct of reading comprehension? Thus, the study attempted to determine if a justification could be made for a timed test such as the ND, and if a justification should be made for more vocabulary instruction and the use of vocabulary as a predictor of ability. Given a need for timed reading tests, the study also probed the usefulness of the DRP.

Review of the Literature

How well do students read at the Western Campus? Gabriel and Richards (1988) measured the reading comprehension of a sample (N = 246) of 099 and 101 English students on the Western Campus during the spring 1988 quarter and found that the mean grade level (GL) for comprehension was 11.2. Since the students were enrolled in entry-level English classes, many of them were new college students. However, the score of the students who were enrolled in entry-level English classes is not representative of the typical student's. Bate (1988), for example, found that the mean (extrapolated) comprehension GL was 13.4 for 46 students enrolled in an evening Psychology 101 class during the same quarter at the College.

What does the research say about the relationship of reading comprehension and vocabulary? The research suggests that there is a correlation between reading comprehension and

vocabulary. Malak and Hegeman (1985) argued that the SAT verbal section could be used when ND comprehension scores were not available. Erwin and Millikin (1980) found what they termed moderately high correlations between the SAT verbal, reading comprehension and vocabulary and the ND's reading comprehension and vocabulary. The ND manual (1976) claims that there is a .81 correlation between the ND vocabulary and the SAT and a .70 correlation between the ND comprehension and the SAT. However, Wood, Nemeth, & Brooks (1985) found only a .15 correlation between the ND comprehension section and the ND vocabulary section.

What is the relationship between reading comprehension and IQ? Reading comprehension is correlated to intelligence. Kirby (1981) found reading was significantly related to intellectual ability. Ryan (1978) found that students with above average intelligence had significantly higher reading scores than did students with average or low intelligence. Roberts (1983) found a .52 correlation between reading comprehension and the WISC-R verbal IQ, .38 with performance IQ, and .50 with full scale IQ.

How do timed and untimed tests correlate? The correlation between timed and untimed tests is suspect. Kerstiens (1986) investigated students' performance on timed and untimed reading tests. There was a correlation of .48 between the Cooperative Reading Test 1A (Coop) given as an untimed test and the DRP. The correlation between the Coop 1A untimed and the Coop 1B timed was .18. There is at least a .66 correlation between the 1A and 1B according to the publisher of the tests. A third comparison between the Coop 1B timed and the DRP produced a correlation of only .05.

What is the correlation between a timed test such as the ND and an untimed test such as the DRP? Wood, Nemeth, and Brooks (1985) found a .27 correlation between the DRP and the ND comprehension section; however, they found a .67 correlation between the DRP and the ND vocabulary section. The ND total score's correlation with the DRP was also .67. The authors pointed out that 83 percent of the students in the sample fell below GL 13, yet students' DRP scores revealed only two percent would be frustrated by college reading assignments.

Methodology

The traditional approach in a study of reading comprehension and vocabulary is to test students who are enrolled in reading classes. The classes, by definition, many times are not structured for students who have adequate college level reading skills. Thus, to get a better representation of college students' reading ability, the base of this study was broadened to include one class at the 09 (pre-college) level, two classes at the 100 (freshman) level, and two 200 (sophomore) level classes. The subjects for the study were 72 students who were enrolled in Language Fundamentals 099 (N = 14), College Composition 101 (N = 8), Principles of Management 112 (N = 7), Business Law 213 (N = 36), and Business Law 214 (N = 7) classes during the summer 1988 quarter at Cuyahoga Community College, Western Campus, in Parma, Ohio.

During the first three weeks of class, students took the Nelson Denny-Form C, Peabody Picture Vocabulary Test, and Degrees of Reading Power-CP1A. The ND comprehension and vocabulary sections were first administered as timed tests; however, the

speed section was not calculated since course objectives do not include speed reading. A total reading score was not calculated because the combination of vocabulary and comprehension was beyond the scope of the study. During subsequent classes, students finished the ND on an untimed basis. Thus, after having worked on the vocabulary and comprehension sections as timed tests during one class session, students were given unlimited time to finish the vocabulary and comprehension sections of both tests. Most students in the 200 level classes finished the comprehension section during the timed (20 minutes) portion of the testing period. The PPVT was administered on an individual basis by the investigators. The DRP is an untimed test.

Instrumentation

To test the null hypotheses, the Nelson Denny, Degrees of Reading Power, and the Peabody Picture Vocabulary Test were used. To develop norms for grade level 13 of the Nelson Denny Reading Test Form C, 1947 students (929 4-year students and 1018 2-year students in grade 13) were given the test in 1972, according to the manual. The Degrees of Reading Power (DRP-CP-1A) is a criterion-referenced test. Thus, comparisons with grade level and norming samples tend to be tricky. The Peabody Picture Vocabulary Test correlates .84 with the verbal section of the WAIS and .79 with the full scale WAIS according to the PPVT manual.

Limitations

The study was limited by the following considerations. First, the classes which were selected to participate in the study may not be representative of the students at the College.

Also, the students who were enrolled in the 200 level classes may have been better readers than the traditional community college students, and the results may not be valid for all College students. Second, the summer quarter may not be representative of the regular academic year. Third, grade 13 levels were used to interpret the ND; many students were beyond entry level, and the grade levels may not be applicable to them, therefore.

Findings

A Pearson correlation coefficient was used to test the null hypotheses. Researchers such as Roberts (1983) felt that a correlation coefficient of .35 was educationally significant; however, for purposes of this study, correlation coefficients were assigned the following values--

0.00 to .20	as slight correlation	(0% to 4% association)
.20 to .40	as low correlation	(4% to 16% association)
.40 to .60	as moderate correlation	(16% to 36% association)
.60 to .80	as marked correlation	(36% to 64% association)
.80 to .90	as high correlation	(64% to 81% association)
.90 to 1.00	as very high correlation	(81% to 100% association)

A functional correlation between the variables, of course, does not always imply a casual relationship.

Table 1

Correlations of ND, DRP, PPVT Values

(N = 57)

Variables	ND comp timed	ND comp untimed	ND voc timed	ND voc untimed	DRP	PPVT
ND comp timed	1.00	--	--	--	--	--
ND comp untimed	.70	1.00	--	--	--	--
ND voc timed	.64	.57	1.00	--	--	--
ND voc untimed	.54	.58	.78	1.00	--	--
DRP	.60	.67	.73	.49	1.00	--
PPVT	.62	.59	.84	.77	.71	1.00

1Ho: There is no marked correlation between the timed comprehension scores on the ND and the untimed comprehension scores on the ND.

The data from Table 1 demonstrate a .70 correlation, and the null hypothesis was rejected.

2Ho: There is no marked correlation between the timed comprehension scores on the ND and timed vocabulary scores on the ND.

According to Table 1, there is a .64 correlation between vocabulary and comprehension scores. Since the correlation was marked, the null hypothesis was rejected.

3Ho: There is no marked correlation between the timed comprehension scores on the ND and untimed vocabulary scores on the ND.

The correlation was .54--moderate, and the null hypothesis was accepted.

4Ho: There is no marked correlation between timed reading comprehension scores on the ND and the comprehension scores on the DRP.

The correlation between the ND comprehension scores and the DRP was marked (.60), and the null hypothesis was rejected.

5Ho: There is no marked correlation between timed reading comprehension scores on the ND and the scores on the PPVT.

The correlation between timed reading comprehension scores and scores on the PPVT was .62, a marked correlation, and the null hypothesis was rejected.

6Ho: There is no marked correlation between the untimed reading comprehension scores on the ND timed vocabulary scores on the ND.

The correlation between untimed comprehension scores and timed vocabulary scores was .57, and the null hypothesis was accepted.

7Ho: There is no marked correlation between the untimed comprehension scores on the ND and untimed vocabulary scores on the ND.

There was a .58 correlation between untimed comprehension and untimed vocabulary scores, and the null hypothesis was accepted.

8Ho: There is no marked correlation between untimed reading comprehension scores on the ND and the comprehension scores on the DRP.

Since the correlation between the untimed comprehension scores on the ND and the scores on the DRP was .67, the null hypothesis was rejected.

9Ho: There is no marked correlation between untimed reading comprehension scores on the ND and the scores on the PPVT.

The correlation between scores on the PPVT and the untimed comprehension tests was .59, and the null hypothesis was accepted.

10Ho: There is no marked correlation between timed vocabulary scores on the ND and untimed vocabulary scores on the ND.

There was a marked correlation (.78) between timed and untimed vocabulary tests, and the null hypothesis was rejected.

11Ho: There is no marked correlation between timed vocabulary scores on the ND and scores on the DRP.

The .73 correlation between the DRP and the untimed vocabulary scores was marked, and the null hypothesis was rejected.

12Ho: There is no marked correlation between timed vocabulary scores on the ND and scores on the PPVT.

The null hypothesis was rejected since there was a high correlation (.84) between the PPVT and the timed timed vocabulary scores.

13Ho: There is no marked correlation between untimed vocabulary scores on the ND and scores on the DRP.

The correlation between the DRP and untimed vocabulary scores was .49, and the null hypothesis was accepted.

14Ho: There is no marked correlation between untimed vocabulary scores on the ND and scores on the PPVT.

The PPVT correlated .77 with the untimed vocabulary scores, and the null hypothesis was rejected.

15Ho: There is no marked correlation between scores on the DRP and scores on the PPVT.

There was a .71 correlation between the scores on the DRP and the PPVT; the null hypothesis was rejected.

Table 2

Scores: ND, DRP, PPVT--Min/Max/SD

	N	Min	Max	Mean	SD
1. ND comp timed	70	7	33	20.0	6.2
2. ND comp untimed	70	11	33	23.1	5.0
3. ND voc timed	71	4	70	33.5	12.8
4. ND voc untimed	68	19	97	59.4	19.8
5. DRP	62	14	62	52.4	9.8
6. PPVT	67	101	141	124.4	10.7

Table 2 shows that mean scores improved for both vocabulary and comprehension on the ND when the students were permitted additional time.

Table 3

Extrapolated Grade Levels and Percentiles

for the ND, Timed

	Min			Max			Mean		
	Score	GL	%ile	Score	GL	%ile	Score	GL	%ile
ND comp	7	6.0	1	33	15+	99	20	13.2	47
ND voc	4	6.8	1	70	15+	97	34	14.2	54

The typical student read at the 13.2 GL in this study; however, his vocabulary was at the 14.2 GL. The 13.2 mean comprehension level is higher than the 11.2 mean comprehension level reported by Gabriel and Richards (1988) for the students in the spring 1988 study but closer to Bate's (1988) finding of 13.4.

Table 4

Min/Max/Mean Reading Levels & Publications

Range of Scores		DRP Units For Independent Level Comprehension (P = .90)	Sample Types of Publications
Min	14	34	Circa 1st grade
Max	62	95	Beyond college text range
Mean	52.9	68	Adult science magazines, New York newspaper

According to the DRP data, the typical student in this study (with a mean score of 52.9) should be able to comprehend the editorial page from a New York newspaper or a science magazine at the independent reading level (P = .90). The DRP manual indicates that college humanities textbooks should present few problems at this level, but natural sciences and social sciences textbooks may be a little more difficult. Students who scored at the low end of the test (score = 14) should be able to read first grade materials at the independent level; students who scored at the high end of the test (62 out of 63 correct items) should be able to comprehend college materials at the independent level.

Table 5

PPVT Extrapolated IQ Scores

	Min	Max	Mean
Score	107	141	126
IQ	96	131	116
%ile	43	99	83

The mean IQ was in the rapid learner category (110-124).

Table 6

Results of Timed ND Comprehension Test

GL	N	%
6	3	4
7	2	3
8	6	9
9	6	9
10	5	8
11	3	4
12	10	14
13	10	14
14	10	14
15	3	4
15+	12	17
total	70	100

The results of the testing indicate that 22 students (31 percent) read at GL 10 or below; 35 students (50 percent) read below GL 13, and 10 (14 percent) students read at GL. There were 13 students (19 percent) who read at GL 14 and 15; another 12 students (17 percent) read above GL 15.

Table 7

Levels of Comprehension at College Readability

(74 DRP Units)

Group	N Items Correct	DRP Units	N Students	% Students
		Frustration Reading Level (P = .50)		
1.	14 - 36	74	5	8
		Between Frustration and Instructional Levels (P = .50 - .70)		
2.	37 - 45	NA	3	5
		Instructional Reading Level (P = .70 - .80)		
3.	46 - 51	74	9	15
		Between Instructional and Independent Levels (P = .80 - .90)		
4.	52 - 56	NA	22	35
		Independent Reading Level (P = .90)		
5.	57 - 63	74	23	37
	totals		62	100

According to Table 7, group 1 (8 percent of the students) would be frustrated with college level reading; these students would be able to deal with materials up to circa grade 4 textbooks on an independent level. Group 2 (5 percent of the students) would be able to deal with books up to circa grade 8 on an independent level. Group 3 (15 percent of the students) read at the instructional level for college materials. This group should be able to read teen magazines and some general interest magazines at the independent level. Group 4 (35 percent of the total) should be able to read most general interest adult magazines and some professional journals at the independent level. Group 5 (37%) should be able to read professional journals at the independent reading level.

Conclusions

A number of interesting conclusions may be drawn from this study.

First, Wood, Nemeth, & Brooks (1985) commented that the ND and the DRP produce different predictions; this conclusion was borne out in the present study. The correlations (.60 for the present study and .27 for the Wood, Nemeth, Brooks study) suggest that the ND and the DRP do not have the same construct of reading comprehension. The ND manual, for example, classifies the types of questions on the test as 50 percent literal level and 50 percent interpretive level questions (36 percent details, 36 percent evaluations, and 28 percent purpose questions). The DRP manual claims to measure what the it calls reading under real life conditions--*minimally inferential comprehension*. The DRP does not claim to measure the products of reading (evaluation judgments) although it does claim to test how well readers understand what the manual calls *surface meaning*. Reading instructors must decide if this *surface meaning* is what they mean by the concept of *reading comprehension*.

Next, instructors must decide how well this concept relates to current research on comprehension and metacognition. Given some connection between the current research on metacognition and what the DRP tests, instructors must look at current comprehension texts to determine if the books follow the current research or if the books reflect the old research which is represented by the ND's emphasis upon specific skills such as making generalizations and deductions, recognizing relationships, and determining the writer's purpose.

Second, the DRP and the ND give conflicting views of the numbers of high risk students. The mean comprehension grade level for students on the ND was 13.2. If frustration level on the ND may be defined as two years below grade level, then 31 percent of the students in the study read at frustration level. According to the DRP scores, eight percent of the students would be at frustration level (two percent of the students in the Wood, Nemeth, Brooks study were at frustration level on the DRP). On the other hand, 87 percent of the students in the DRP testing were at instructional (college level) or better; on the ND, only 50 percent of the students were at least grade level 13. Why the predictions differ may be due to the ND's emphasis upon testing reading skills and the DRP's emphasis upon testing surface meaning.

Third, there is a high correlation (.84) between the PPVT and the timed vocabulary section of the ND; there is a marked correlation (.77) between the PPVT and the untimed vocabulary section of the ND. If the PPVT is a measure of ability, these correlations between the ND vocabulary and the PPVT suggest that the vocabulary section of the ND can be used to estimate students' ability (not performance).

The DRP correlated .71 with the PPVT and .73 with the ND timed vocabulary--the DRP showed higher correlations with intelligence/vocabulary than with the ND timed comprehension (.60). The correlation between the PPVT and ND timed vocabulary was .84. These figures suggest that the DRP may be a better measure of a student's ability, IQ, or vocabulary than of his reading comprehension if *comprehension* is seen as a set of skills.

Four, a correlation between reading comprehension and intelligence was borne out. The correlation between the PPVT and the timed ND comprehension was .62; the PPVT correlated .71 with the DRP. However, several other correlations with the DRP proved to be interesting.

Five, the usual explanation for the gap between comprehension (13.2 GL) and vocabulary (14.2 GL) is that the comprehension score is a measure of performance, and the vocabulary level is an indication of ability--see Table 3.

Six, the .70 correlation between the ND comprehension timed and untimed might be explained by the nature of the students who took the test. The majority of the students in the business classes finished the test within the twenty minute time period and did not choose to continue to work on the test when they were given the opportunity to spend additional time.

Recommendations

In light of the study, the following suggestion are proffered at the campus level and at the national level.

Campus level.

1. As a timed test, the ND should no longer serve as the test of choice to measure the reading comprehension of students on the Western campus.

2. If *comprehension* is defined as a series of skills, then the DRP should not be used to measure the reading comprehension of Western's students. However, if instructors can begin to see *comprehension* in terms of the research which is being conducted on metacognition, the DRP may be a better gauge of comprehension than the ND. If the DRP is selected as the test of choice by the department, instructors should understand that there are two problems. First, the DRP may be a better measure of ability (vocabulary) than of performance (*comprehension* in the sense of a series of skills). The test also appears to overestimate the reading comprehension capabilities of many students.

3. A reading test should be administered to entry-level students each fall quarter to evaluate students' reading levels.

4. An attempt should be made to determine if the current reading comprehension textbooks on the market follow current research on reading comprehension and vocabulary. One can not assume that reading texts have followed the current research any more than one can assume that a test which was developed in 1972 is still valid and reliable in 1988.

National level.

The following suggestion are offered at the national level.

1. The statistical validity of the DRP should be

analyzed to determine if the test is a better measure of reading comprehension or a reflection of vocabulary or of intelligence.

2. The use of the ND and other timed tests is not above reproach. Clary (1973) noted that as early as 1969, Farr had called for untimed tests. Kerstiens' (1986) research and the results of the present study question the usefulness of timed reading tests.

3. Since the correlation between the ND vocabulary timed and the PPVT is .84 (the correlation of the ND vocabulary untimed and the PPVT is .77), the vocabulary section of the ND should be investigated as a tool to estimate the potential for reading comprehension.

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